

Greater Green River Basin Production Improvement Project: Rock Island 4-H Well, Table Rock Field, Frontier Formation

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Abstract

The UPR Rock Island 4-H well, located on the north plunge of Table Rock Field in Sweetwater County, Southwest Wyoming (S4-T19N-R97W), is the culmination of 5 years of cooperative government and industry research in the DOE Greater Green River Basin Production Improvement Project, a research partnership between DOE-FETC, Union Pacific Resources and GRI. The primary goal of this project is to explore technologies which could make production of the very large tight gas resources in southwestern Wyoming technically and economically feasible. The Union Pacific Resources Rock Island 4-H well (UPR RI 4-H) appears to be a successful attainment of this goal in the area north of Table Rock Field.

Notable milestones achieved in the span of this project include:

- (1) The reduction of drilling time and expense for vertical wells deeper than 15,000' to less than half of the average time and cost encountered by industry during the last decade. This is critical to making deep, vertical or horizontal tight gas sandstone wells a viable option.
- (2) One of the deepest horizontal tight gas sandstone wells in the world (>14,950' TVD).
- (3) Greater than 95% recovery of three of the deepest horizontal cores in the world.
- (4) One of the highest unstimulated, sustained gas flow capacities (12-14 MMCFD) ever encountered in the tight-gas province of the Cretaceous Frontier Formation in Wyoming.
- (5) The initiation of ongoing plans for a horizontal drilling effort by industry to evaluate and exploit this previously unattainable resource.

The UPR RI 4-H offsets a vertical completion by 1.5 miles to the east-northeast (Government Union #4 well, S8-T19N-R97W). Core and log information and production test data from the Government Union #4 well (GU #4), combined with structural data derived from approximately 1000 square miles of 3-D seismic data were major factors in the site selection for the UPR RI 4-H horizontal well. The reservoir is highly fractured, massive to hummocky cross-stratified, very-fine

grained, nearshore marine (lower shoreface) sandstone, with 10-12% porosity and 25 microdarcies permeability.

Fractures in vertical core from GU #4 and the horizontal core from the UPR RI 4-H exhibit slickensides and bedding offset which document shear displacement with a dominant strike in the range of 80-110 degrees. The fractures are open to partially filled with quartz, calcite, kaolinite and bitumen. Fracture spacing is variable within the horizons penetrated and fracturing appears to be most intense near several small faults penetrated by the well. Work by John Lorenz with Sandia National Labs and David Campana with ARI documents that the open fractures which strike east-west, nearly perpendicular to the well bore, occur along the entire horizontal length of the UPR RI 4-H well, as observed in core and resistivity image log data.

We anticipate that the success of the UPR Rock Island 4-H Well will spark renewed drilling by industry in the Greater Green River Basin. Horizontal drilling is attractive because it allows large well spacings, making per well recoveries larger while greatly reducing the environmental impact of the drilling program. Union Pacific Resources and its partners are forming a Federal Unit to efficiently develop this play. Further testing of advanced drilling and stimulation techniques will occur as industry works to optimize technological and economic solutions. This project underscores the value of government and industry research partnerships aimed at solving problems which the private sector alone has been unable to solve within the present challenging economic environment of the energy industry.

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